Building a file-based Storage Stack: Modularity and Flexibility in Loris

Appuswamy, R.

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BUILDING A FILE-BASED STORAGE STACK

Raja Appuswamy

All modern operating systems use a multi-layered collection of protocols, often referred to as the storage stack, for providing the familiar hierarchical file system abstraction to applications. Similar to other protocol stacks, layers in the storage stack expose well-defined abstraction boundaries. Protocols grouped within each layer communicate with those in other layers using standardized interfaces. However, unlike the systematic, design-based evolution of layering in other stacks, layering in the storage stack evolved based on one factor—backwards compatibility.

In this thesis, we examine the traditional storage stack along three dimensions, namely, reliability, flexibility, and heterogeneity. We identify several issues that plague the storage stack along each dimension, and show how the compatibility-driven addition of protocols in the storage stack is the root cause of all these issues. In doing so, we make the case for retiring the traditional storage stack, as it is both ineffective in managing modern-day storage installations and incapable of accommodating future changes in the storage hardware landscape. We then present Loris, a clean-slate redesign of the storage stack that solves all the issues that plague the traditional stack by design.

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